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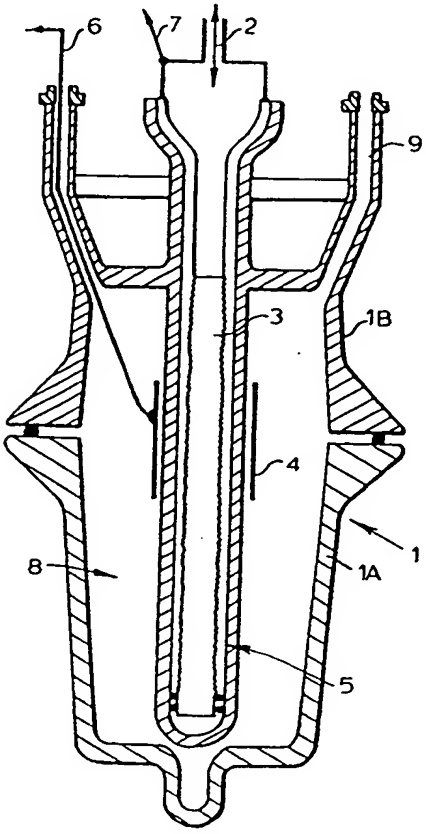
(57) Abstract

A process for producing energy comprising: filling a body with at least one hydrogen isotope, at least a part of the body comprising at least one metal capable of forming a metal hydride type lattice system, arranging the body filled as at least part of the one conductor element of a capacitor means within an electrical circuit, the other conductor element of said capacitor means being connected with an externally controllable voltage supply means, operating said voltage supply means, and recovering energy produced within said body by operating said voltage supply means, in wich process an ozoniser is used as capacitor means. The invention further relates to an energy source system for carrying out the process. The energy source system suitably includes a working machine as a part of an integrated power cycle.

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# ENERGY SOURCE SYSTEM AND PROCESS

The present invention relates to a specific energy source system and to a method for producing energy using said energy source system.

In International PCT Application Publication WO 91/01036 a method for producing energy has been described comprising filling a body with at least one hydrogen isotope, at least a part of the body comprising at least one metal capable of forming a metal hydride type lattice system, arranging the body filled as at least part of the one conductor element of a capacitor means within an electrical circuit, the other conductor element of said capacitor means being connected with an externally controllable voltage supply means, operating said voltage supply means and recovering energy produced within said body by operating said supply means.

The subject matter of WO 91/01036 has been incorporated by reference into the present specification.

It has now been found that an ozoniser type of discharge can be used advantageously to effect the production of energy when the discharge takes place in a hydrogen isotope environment in the presence of a metal capable of forming a metal hydride type lattice.

The present invention therefore relates to a process for producing energy, which process comprises:

- filling a body with at least one hydrogen isotope, at least a part of the body comprising at least one metal capable of forming a metal hydride type lattice system,
- arranging the body filled as at least part of the one conductor element of a capacitor means within an electrical circuit, the other conductor element of said capacitor means being connected with an externally controllable voltage supply means,
- operating said voltage supply means, and

- recovering energy produced within said body by operating said voltage supply means,

in which process an ozoniser is used as capacitor means.

It has been found that the use of an ozoniser type discharge allows the use of hydrogen as well as of deuterium whilst also different metals, including palladium and (stainless) steel can be used advantageously as metals capable of forming hydride type lattices.

It is another object of the present invention to provide a reliable and consistent energy delivery system equipped with controllable starting means, shut down means, and restarting means.

It is yet another object of the present invention to provide an operable energy source system having operating conditions which can be modified easily.

It is a further object of the present invention to provide an energy source system which is suitably coupled to a working system. Furthermore, it is an object of the present invention to design and develop an energy source system which can be integrated in existing power cycles.

Reference is made to an article entitled "Copious low energy emissions from palladium loaded with hydrogen or deuterium" by R.K. Rout et al. (Indian Journal of Technology, Vol. 29, December 1991, pages 571-578) in which the occurrence of low energy radiations is reported from loading palladium with hydrogen or deuterium, as measured by autoradiography. In the article nothing has been said on the use of capacitor means as voltage supply means, let alone ozoniser type of discharges and it is specifically stated that no fogging of autoradiographs (the normal way of measuring low energy radiation) was observed when using zirconium, hafnium and niobium under otherwise identical conditions.

The present invention also provides an energy source system, comprising:

- a body, at least part of the body comprising at least one metal capable of forming a metal hydride type lattice system and being at least part of the one conductor element of an

ozoniser as capacitor means of which the other conductor element is connected to an externally controllable voltage supply means, said capacitor means and said voltage supply means forming an electrical circuit,

- a supply means for supplying at least one hydrogen isotope to be introduced into said body, and
- a recovery means for recovering energy produced within said body.

Without wishing to be bound to any particular theory it is believed that the energy released using the method and system according to the present invention is generated according to the the theory of the constant electrical field value as described in WO 91/01036. In particular reference is made to the assumed occurrence of an electrical surface charge within the metal/-dielectric interface.

It has been found that the release of energy can be obtained both when using hydrogen or deuterium as the hydrogen isotope to which the body is to be exposed. It has been found that in particular good effects can be obtained using hydrogen either as such or in the presence of other hydrogen isotopes, notably deuterium.

The discharge means to be used in the process according to the present invention allows the use of hydrogen as the hydrogen isotope. Deuterium can also be used advantageously as can be mixtures of hydrogen and deuterium, irrespective of their mixing ratio. If desired, other gaseous materials can be present but they do not contribute to the release of energy. Examples of such gaseous materials are the noble gases and nitrogen.

The metals which can be used in the method for producing energy in accordance with the present invention comprise those metals which are capable of forming metal hydride type lattices. The occurrence of metal hydride type lattices has been described extensively in the art, both from a theoretical point of view and from an experimental point of view.

Palladium, of course, has been described most extensively of all metals because of its capability of forming metal hydrides, in particular metal hydrides with high concentrations of the hydride component (be it hydrogen or deuterium). It is quite understandable that the art has been focused on palladium since palladium hydride structures are rather easy to obtain contrary to other (noble) metals.

It has been found that the method according to the present invention can be operated using many different metals, including such metals which are not normally featuring as preferred hydride-forming metals such as iron. Very good results have been obtained using stainless steel as the body to be filled with a hydrogen isotope, be it hydrogen or deuterium. This substantially widens the window of application in this technical area.

Metals capable of forming a metal hydride type lattice system, which metals are to be used in the process according to the present invention, comprise metals and alloys having vacancies in their d and/or higher atomic energy levels. Examples of such metals are titanium, vanadium, chromium, manganese, iron, cobalt, nickel, zirconium, niobium, molybdenum, ruthenium, rhodium, palladium, lanthanum (and the lanthanides), hafnium, tungsten, rhenium, osmium, iridium and platinum. Preferred metals comprise titanium, iron, nickel and palladium. Most preference is given to the use of nickel alloys and palladium.

It should be noted that the expression stainless steel as used herein embraces the various kinds of alloys of iron which are normally referred to as stainless steel. Main components besides iron are nickel and/or cobalt. Small amounts of carbon are also present in stainless steel.

The process according to the present invention can be suitably carried out using an ozoniser-type discharge apparatus as described in Figure 1.

An ozoniser normally comprises two metallic electrodes, at least one of them being shielded by a dielectric barrier such as glass or a ceramic moiety. It should be noted that there is no

direct sparking or arcing between the electrodes of an ozoniser. It should also be noted that the process according to the present invention cannot be operated when both electrodes are shielded completely. Preferably, one of the electrodes is shielded completely in the process according to the present invention whilst the other electrode is a bare one.

The apparatus depicted in Figure 1 comprises a vessel 1, typically of glass, having an inlet 2 for gaseous material connected to a storage cylinder (not shown) for the gaseous material to be used in the experiments (hydrogen, deuterium, argon or nitrogen). Inlet 2 can conversely be used to produce a vacuum inside vessel 1 if desired so.

The electrodes present within the vessel comprise a stainless steel electrode 3 having a diameter of 11 mm and a shielded copper electrode 4. The stainless steel electrode 3 is located within glass tube 5, serving to provide the ozoniser discharge.

The high voltage to be supplied when the apparatus is being operated, is produced via an external circuit (not shown for reasons of clarity) which enters vessel 1 via line 6 which is connected to the shielded copper electrode 4. Connection to ground is provided by line 7 which is connected to the stainless steel electrode 3.

The area 8 is normally used for calibrating purposes and is filled conveniently with deuterium or argon which is not subjected to any discharge. Deuterium or argon can be introduced or withdrawn via inlet opening 9. When one would operate an open ended tube 5 (not shown) the inlet opening 9 could be used to introduce the appropriate gas (deuterium or hydrogen) to vessel 1.

Vessel 1 is constructed of two parts (1A and 1B) which are mutually removable in order to allow replacement of the ozoniser and/or the electrode(s) within the vessel.

In order to exclude temperature fluctuations and other possible external factors the vessel 1 is kept inside a large barrel filled with oil (not shown) which is kept at a constant temperature by means of temperature control means. If desired,

various measuring devices can be installed either inside or outside vessel 1, depending on the type of measurement envisaged.

The process according to the present invention is normally carried out as follows. The appropriate gas (hydrogen and/or deuterium) is introduced into vessel 1 via inlet opening 2, having been provided from a storage vessel. The high voltage device is then switched on allowing an ozoniser type discharge to be created in the gas between the shielded electrode 4 and electrode 3. The generator used delivers a succession of damped voltage oscillations. The frequency of the voltage oscillations normally ranges between 2000 and 3000 Hz with peak voltages ranging between 15 and 20 kV. The number of pulses per second is normally about 300.

To measure the effects due to the process according to the present invention the electrical energy delivered to the system is measured precisely and compared with the thermal energy released when operating the system. The electrical energy delivered to the system is normally measured by recording the DC Voltage and intensity of the power input to trigger the high frequency high voltage oscillations. The thermal energy released in the system is normally measured using calibrated calorimeters.

The energy produced when operating the system according to the present invention will normally be recovered in the way as discussed in more detail in WO 91/01036. In particular, reference is made to Figure 2 of WO 91/01036.

Suitably, a heat exchange means is provided to allow energy transfer and/or energy transport. Both a solid arranged as an energy transfer means and a fluidum or fluidum flow respectively as an energy transfer or an energy transport means can be used. Furthermore, channels passing through said solid and conducting a fluidum or fluid flow like above can be employed.

Advantageously, the heat exchange means includes or is part of a power cycle means, thereby forming part of a circuit means (not shown) to allow recovery of energy. Furthermore, the fluidum can be

pressurised, if desired using a pumping or pressurising device (not shown) to enhance the efficiency of the energy recovery. Advantageously, pressures between 100 kPa and 10000 kPa can be used.

As fluidum hydrocarbons and/or derivatives thereof, and also water, can be suitably applied. In particular hydrocarbons and/or derivatives thereof, advantageously having large dielectric constants and breakdown values, are preferred.

The above energy recovery means can be coupled suitably to a working machine (not shown) resulting in an integrated power cycle, Thus, existing cycles can be implemented economically with the source system in accordance with the present invention.

The invention will now be illustrated by means of the following Examples.

Example 1

Deuterium was introduced into vessel 1 via inlet opening 2 having been provided from the storage vessel. The deuterium used was Air Liquide N 27 quality. The vessel contained as one electrode a palladium cylinder positioned around a stainless steel electrode holder and which was electrically connected thereto. The stainless steel electrode holder was not exposed to deuterium. The other electrode consisted of copper foil wrapped around the glass tube serving as the dielectricum. The copper foil was also connected to the high voltage generator. The stainless steel electrode holder was connected to the common ground.

The high voltage generator was then switched on, delivering damped oscillations at a frequency of 310 Hz at a peak voltage of 17 kV resulting in the generation of an ozoniser type of discharge. The system was kept running for two days after which thermal equilibrium had been established. An energy balance of the system was made. This resulted in the following data: The electrical energy (power) put into the system amounted to 29.97 W. The thermal energy released in the reactor amounted to 4.62 W and the thermal energy released in the high voltage generation system amounted to

26.97 W meaning that an excess energy of 1.62 W had been produced in the reactor.

Example 2

The experiment described in Example 1 was repeated using an electrical energy (power) input of 29.96 W. The thermal energy released in the reactor amounted to 5.51W and the thermal energy released in the high voltage generation system amounted to 26.28 W meaning that an excess energy of 1.84 W had been produced in the reactor.

Example 3

The experiment described in Example 1 was repeated but this time the stainless steel electrode holder was used as the one electrode. The stainless steel electrode had been produced from commercially available stainless steel tubing.

The high voltage generator delivered damped oscillations at a frequency of 312 Hz. The electrical energy (power) input amounted to 28.21 W. The thermal energy released in the reactor amounted to 8.05 W and the thermal energy released in the high voltage generation system amounted to 22.3 W meaning that an excess energy of 2.14 W had been produced in the reactor.

Example 4

The experiment described in Example 3 was repeated but operating the high voltage generator in such a way that it delivered damped oscillations at a frequency of 179 Hz. The electrical energy (power) input amounted to 23.69 W. The thermal energy released in the reactor amounted to 5.54 W and the thermal energy released in the high voltage generation system amounted to 19.64 W meaning that an excess energy of 1.49 W had been produced in the reactor.

Example 5

The experiment described in Example 3 was repeated using a fresh stainless steel electrode holder serving as the one electrode and using hydrogen instead of deuterium. The stainless steel electrode had not been exposed to deuterium at all. The high voltage generator delivered damped oscillations at a frequency of

310 Hz. The electrical energy (power) input amounted to 29.87 W. The thermal energy released in the reactor amounted to 6.06 W. The thermal energy released in the high voltage generation system amounted to 25.48 W meaning that an excess energy of 1.67 W had been produced in the reactor.

Example 6 (comparative)

An experiment was carried out in vessel 1 which vessel was provided with an additional glass barrier to shield completely the stainless steel electrode. This set up was in effect a double dielectric barrier ozoniser. Deuterium was introduced between the dielectric barriers via inlet opening 2 from a storage vessel. The area 8 was filled with air.

Again, the high voltage generator was operated in such a way so as to deliver damped oscillations at a frequency of 310 Hz. The electrical energy (power) input amounted to 28.55 W. The thermal energy released in the reactor amounted to 2.46 W and the thermal energy released in the high voltage generation system amounted to 26.30 meaning that an excess energy of 0.21 W had been produced in the reactor which is within the experimental error. This experiment demonstrated that no heat was produced in this case.

## C L A I M S

1. Process for producing energy, comprising:
- filling a body with at least one hydrogen isotope, at least part of the body comprising at least one metal capable of forming a metal hydride type lattice system,
- arranging the body filled as at least part of the one conductor element of a capacitor means within an electrical circuit, the other conductor element of said capacitor means being connected with an externally controllable voltage supply means,
- operating said voltage supply means, and
- recovering energy produced within said body by operating said voltage supply means,

in which process an ozoniser is used as capacitor means.

2. Process according to claim 1, wherein use is made of an ozoniser wherein one of the electrodes is completely shielded whilst the other is a bare one.

3. Process according to claim 1 or 2, wherein use is made of an ozoniser of which one electrode is provided with glass or a ceramic moiety as shielding means, preferably glass.

4. Process according to any one of claims 1 to 3, wherein the hydrogen isotope used is hydrogen or deuterium, preferably hydrogen.

5. Process according to any one of claims 1 to 4, wherein use is made of metals or alloys having vacancies in their d and/or higher atomic energy levels, preferably titanium, iron, nickel or palladium, more preferably nickel alloys or palladium.

6. Process according to any one of claims 1 to 5, wherein use is made of hydrogen and stainless steel.

7. Process according to any one of claims 1 to 6, wherein a high voltage generator is used to produce a succession of damped oscillations having a frequency between 2000 and 3000 Hz.

8. An energy source system, comprising:

- a body, at least a part of the body comprising at least one metal capable of forming a metal hydride type lattice system and being at least part of the one conductor element of an ozoniser as capacitor means of which the other conductor element is connected to an externally controllable voltage supply means, said capacitor means and said voltage supply means forming an electrical circuit,
- a supply means for supplying at least one hydrogen isotope to be introduced into said body, and
- a recovery means for recovering energy produced within said body.

9. The system according to claim 8, wherein one of the electrodes is completely shielded and the other is a bare one.

10. System according to claim 8 or 9, wherein glass or a ceramic moiety provides the shielding means, preferably glass.

11. System according to any one of claims 8 to 10, wherein the voltage supply means comprises a high voltage generation means capable of producing a succession of damped oscillations ranging between 2000 and 3000 Hz, and preferably capable of producing peak voltages ranging between 15 and 20 kV.

12. System as claimed in claim 8, wherein the recovery means comprises a heat exchange means, preferably a fluidum flow arranged as an energy transport means.

13. System according to claim 12, wherein the fluidum comprises hydrocarbons and/or derivatives thereof.

14. System according to any one of claims 8 to 13, wherein the system is coupled to a working machine as a part of an integrated power cycle.

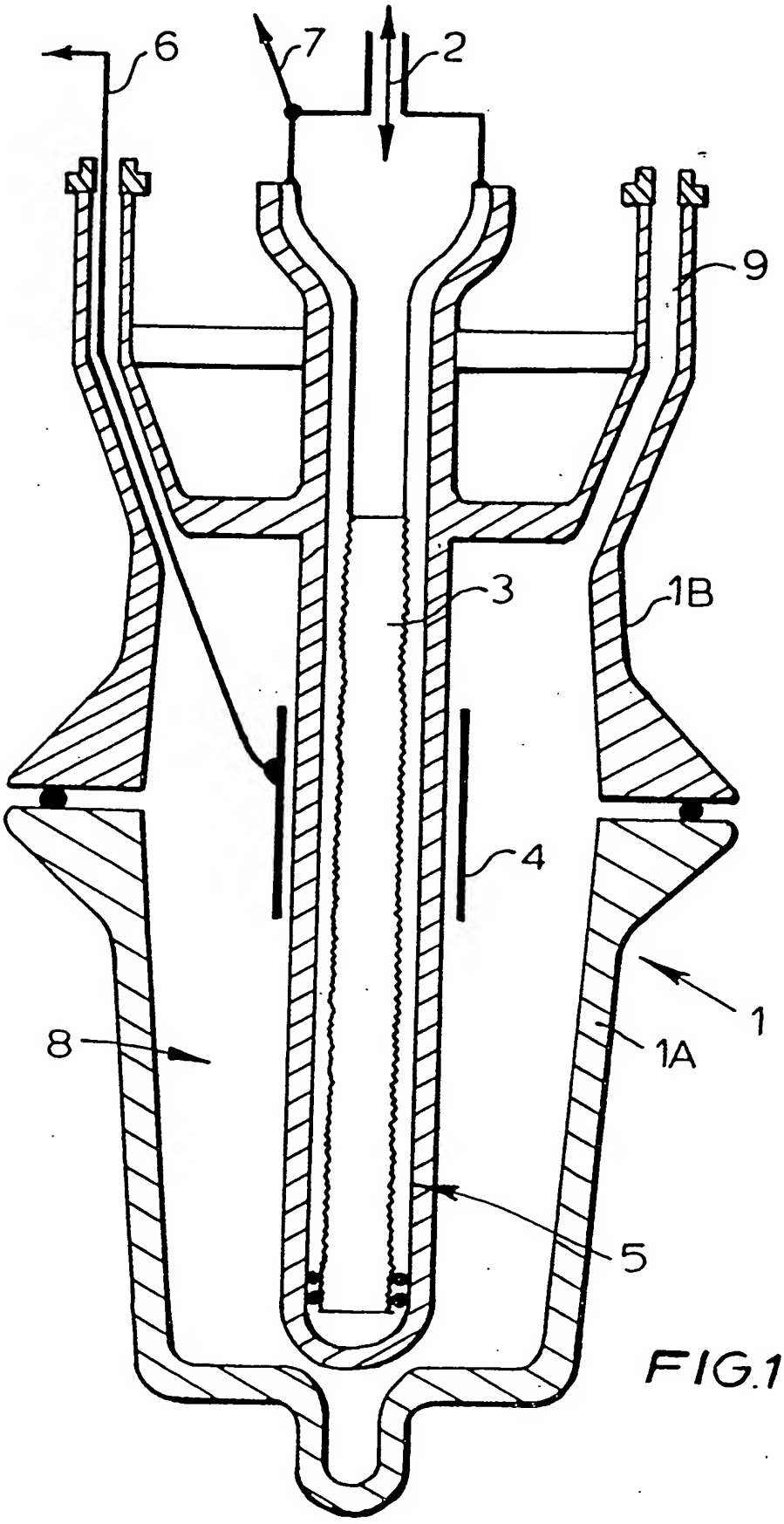


FIG.1

A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 G21B1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 5 G21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | WO,A,91 01036 (SHELL INT. RES. MAAT.) 24 January 1991 cited in the application see the whole document | 1-5, 7-10, 12-14 |
| A | --- | 11 |
| Y | US,A,4 461 744 (ERNI ET AL.) 24 July 1984 see claim 1 | 1-5, 7-10, 12-14 |
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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|---|---|---|
| A | FUSION TECHNOLOGY<br>vol. 19, no. 2 , March 1991 , LAGRANGE PARK, ILLINOIS US<br>pages 391 - 394 XP179448<br>ROUT ET AL. 'Detection of high tritium activity on the central Titanium electrode of a plasma focus device'<br>see page 391, right column, last paragraph - page 392, left column, last paragraph | 5,6 |
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| | | EP-A- | 0482091 | 29-04-92 |
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